drawal and date are noted on this card, which is then refiled. Card 12 of the numerical index is withdrawn and replaced by a new one, at the same time peg 12 is taken from the board and placed in the side compartments, the vacant peg-hole showing at a glance the availability of this locker. In assignment of available lockers, one need only bear in mind that two pegs of the same color can not be placed on the same desk, and thereby conflict will be avoided. Thus, without multiplying examples, it at once becomes apparent that this system gives one a ready and simple control of the laboratories. By this system, classes of seven hundred are handled with great facility.

The writer wishes to express his thanks to Mr. Harry Mougey, of this laboratory, for several suggestions made in the construction of the above board.

WM. LLOYD EVANS
OHIO STATE UNIVERSITY,
September 8, 1909

EDUCATIONAL AIMS IN THE TEACHING OF ELEMENTARY GEOMETRY, HISTORICALLY CONSIDERED[1]

THE two educational aims that have stood out distinctly in the history of the teaching of geometry are the practical[2] and the logical. Of course in the early development of geometry the term teaching can not be used with its modern significance. The practical side of geometry was developed by the Babylonians, the Egyptians and the Romans; the logical by the Greeks. In the medieval universities the little geometry taught was according to Euclid. England has followed the same standard to the present day. The other European countries, for the most part, have combined both of these aims, and this obtains to-day, with the emphasis on the logical. The same is true in the United States. A third aim in the teaching of geometry arose when the secondary schools began to assume the character of preparatory schools for the universities. The last hundred years have seen this generally brought about, and within the last fifty years it has been fully systematized in the various countries. In treating these several aims it is impossible to completely separate them.

The early Egyptians and Babylonians developed geometry as a means toward a practical end. Both nations were interested in astronomy, and hence a rudimentary geometry found a place with them. The Egyptians employed geometric principles in the building of their pyramids and in surveying. They measured lengths and areas, they built solids of regular design, they showed some skill in geometric drawing in their mural decorations. With all this they experienced the necessary propædeutics for a developed science, yet this development never came. Whether it was the lack of God-given powers or due to the conservatism of the priestly class, that sacredly guarded the learning, one can only conjecture.

The Romans, also, valued geometry for its utility, employing it in architecture and in surveying. But, unlike the Egyptians, they had the learning of other nations to draw upon. This development in architecture and surveying was marked in the first century before and the first century after Christ. Euclid had written his "Elements" approximately three hundred years earlier. Archimedes had already developed geometry as applied to mechanics, and Heron of Alexandria, who studied and wrote on practical geometry and surveying, lived in the early years of this "Roman" period. The work of Heron influenced the Roman surveyors, but Euclid found little favor with the Romans. When the "Elements" was recognized at all, it was that it might be of aid in the training of the orator, which was, for the Romans, a practical aim. In like manner the Hindus and Arabians studied geometry primarily for its practical value, although both of these nations were largely dependent upon the Greeks for their knowledge of geometry.

[1] See the author's "A History of the Teaching of Elementary Geometry," Teachers College Contributions to Education, No. 23, for the original and secondary sources consulted. The present article is not an integral part of the larger work, but material from the latter is utilized in the former.

[2] The term practical is used with reference to the applications of geometry within the field of mathematics or in the related fields of science.

The nations that have been considered thus far emphasized only the practical side of geometry, and we find with them no plan of education that provided for its systematic instruction. The early Christian schools taught geometry in a small way, but the practical was almost entirely neglected. The medieval universities made provision for the applications of geometry, but such work was independent of Euclid.

The Greeks were the first nation that developed and consistently taught a logical system of geometry. Although they were interested in astronomy and the physical sciences (which undoubtedly stimulated their study of geometry), yet the practical was completely divorced from the logical, as is shown in the text of Euclid. The chief function of education, according to the old Greek idea, was the perfection of the human being, body and soul. Hence gymnastics and music constituted almost entirely the program of studies for the growing boy. When the new education with its philosophy and mathematics entered into the Greek life, it served as the completion of an edifice whose foundations had already been laid. Hence the logic of geometry thrived in Greece. But in the development of this science, the Greeks were stimulated by a sort of practical aim in attempting to solve the three famous problems of antiquity: the quadrature of the circle, the duplication of the cube, and the trisection of any angle. In the actual teaching of the subject, however, the Greeks were more interested in the chain of reasoning than in the subject-matter itself.

Logical geometry next found a place in the medieval universities. Under the influence of monasticism and mysticism the church schools were more interested in religious than in intellectual things. Then scholasticism arose and dominated European education from the eleventh to the fifteenth century. It sought "to bring reason to the support of faith," and logical inquiry was stimulated. The universities began their careers under such influences, and when Euclid became known to medieval Europe, it found a place in the curricula of these institutions, where it was taught in the highest class. Undoubtedly it was looked upon as the instrument that completed and knit together the logical faculties of the mind. The universities did not neglect science. In particular the "sphæra" was studied, but it bore no relation to the logical study of geometry. A thing for us to remember is that these institutions followed the example set by the Greeks. Geometry and the physical sciences were both studied, but the former was developed without any reference to the latter.

In the teaching of geometry, the different European countries have held to the strictly logical in varying degree. Italy has Euclidean traditions, but England above all has taught geometry primarily on the logical basis. Euclid has there reigned supreme. Until recent years English higher education has meant the education that fits for the so-called higher callings. The public schools, which prepare largely for the universities, have had this same conception. Any training that smacked of "trade" was not considered to be a part of the education of an English gentleman. The result has been that the classical side has been particularly emphasized and practical education has been almost neglected. In recent years the modern university movement in England has furthered technical and industrial education, and we now find secondary and higher technical schools that are beginning to fill this gap in the English school system.

Thus far we have mentioned the marked tendencies among certain nations and institutions to hold either to the practical or the logical in the teaching of geometry. With reference to other nations, Germany and France, for instance, have never held to the rigors of Euclid, and Russia has begun only in comparatively recent years to emphasize the scientific teaching of geometry. Let us look into the aims in some of those countries where the extremes of aim have not been so disassociated.

The Renaissance of the fifteenth and sixteenth centuries brought no change in the teaching of mathematics in the universities. This result could hardly be expected from a movement entirely classical in its nature. It was not until the latter part of the seventeenth century, under the influence of realism, that

the universities began to change the character of their work, and modern science was included in the curricula. The geometry taught in the secondary schools of Germany up to the seventeenth century was taught largely in connection with astronomy and surveying, copied after the work done in some of the medieval schools. The logical aim became more prominent by the beginning of the eighteenth century when science began to assume its more modern form.

In Russia, geometry was first taught from the practical standpoint. The logical aim was long in getting recognition. It was not until the end of the eighteenth century that geometry received any great attention as a science. In France, the early texts show that the practical in geometry was valued as well as the logical. In Holland, the beginning was practical, the eighteenth century marking a more logical trend, when the teaching was made systematic. In the United States, the first geometry taught was of a practical nature, but the English influence was soon felt, and it was not until the first quarter of the nineteenth century that the more practical geometry of the French began to replace the English Euclids.

Another aim has characterized the teaching of geometry, an aim different from the two already considered, but still not standing apart from them. It is associated with the study of geometry as a preparation for advanced work in mathematics. This aim is a recent one in the teaching of geometry. Before the latter part of the eighteenth century, in no strict sense could the secondary schools that have here been considered be called preparatory schools for the higher institutions.

It was not until 1788 that the Prussian government required an examination from all who entered the universities, and it seems that this was not at first rigidly enforced. One may safely judge that previous to 1788 the aim of preparing for advanced study was not a dominant one in the gymnasia. On the creation of the lycées in France by Napoleon in 1802, these schools began to assume the character of preparatory schools for the university and the various government schools. In England, the secondary schools did not begin to teach Euclid until the early part of the last century, and it was not required in general until about the middle of that century. It has been only within fifty years that these schools have in any strict sense prepared for the universities. In Russia, students at first passed from the seminaries and the ecclesiastical academies into the universities, but in 1759 the gymnasia began to act as preparatory schools. The secondary schools of Holland began to prepare for the university in 1815, but as far as geometry was concerned, the requirements were not strictly defined. In the United States the universities did not require geometry for entrance before 1844. Since that date the high schools have assumed more and more the function of preparing students for advanced work in the universities.

One of the results of this close relation between the university and the secondary school has been an improvement in the teaching of geometry from the scientific standpoint, but, in the United States at least, while the teaching of geometry has been better developed logically, its practical side has been correspondingly neglected in the high schools.

ALVA WALKER STAMPER

CHICO, CAL.

A NEW NAME FOR A NEW SCIENCE[1]

THE following list, though noticeably brief, attempts to include all books and memoirs in which the facts of history of a personal nature have been subjected to statistical analysis by some more or less objective method. Such researches may be made to contribute to the science of eugenics. They also stand upon the border line of the allied sciences, psychology, anthropology and sociology. Since investigations of this nature contribute to several sciences, and at the same time primarily

[1] "Some Desiderata in the Science of Eugenics and Bibliography of Historiometry," by Dr. Frederick Adams Woods. Reprinted from Vol. V. of the American Breeders' Association Report of the Meeting, held at Columbia, Mo., January 6, 7 and 8, 1909. Report of the Committee on Eugenics. Bibliography of Historiometry (Quantitative History) now printed for the first time.